OWNER'S MANUAL

Indoor Air Quality Meter

Model IAQ50

AIRFLOW™
INSTRUMENTS
TSI Incorporated

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Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call Customer Service department at +44 (0) 149 4 459200 (UK), (800) 874-2811 (USA), or (1) 651-490-2811 (International).

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SECTION 1
General Description

The Model IAQ50 measures Carbon Dioxide (CO_2) level, temperature and relative humidity, and calculates dew point and wet bulb. It also calculates the percentage of outside (make up) air in a given indoor space, using CO_2 levels, or temperature. The instrument will determine statistics and recall individual data points for up to 255 test IDs. The Model IAQ50 will retain data even after it is turned off.

The IAQ50 ships in a soft-sided carrying case that holds the meter and probe, a probe stand, and calibration collar. There is space in the case for an optional Micro-Printer and charger. The instrument ships with batteries (which are not installed), a calibration sheet, and this Owner's Manual.

SECTION 2
Safety

When using the IAQ50 to check for CO_2, temperature or humidity values, make certain that you can safely raise and hold the instrument while making measurements. Be especially careful when working on a ladder.

Observe all necessary precautions so that the unit does not become caught in moving machinery or touch any exposed electrical wiring.

DANGER!

Use with corrosive or other dangerous or explosive gas mixtures is not recommended.

WARNING!

Do **not** expose the sensing probe to excessive heat—it can damage the sensors and probe.

SECTION 3
Setting-Up

Supplying Power to the Model IAQ50

The Model IAQ50 can be powered in one of two ways: four AA-size batteries or an optional AC adapter.

Installing the Batteries

Insert four AA batteries as indicated by the diagram located on the inside of the battery compartment. The Model IAQ50 is designed to operate only with alkaline batteries, which are included. At 15% battery life remaining, the battery indicator will show that the batteries need to be changed.

Using the Optional AC Adapter

The optional AC adapter allows you to power the Model IAQ50 from an AC outlet. When using the AC adapter, the batteries (if installed) will be bypassed. The AC adapter is NOT a battery charger.

Start up Sequence for the Model IAQ50

When the instrument is turned on, all segments of the display will light up and then the meter goes through a start-up sequence.

Battery Percentage

This shows the remaining amount of battery power.

Log Percentage

This shows how much of the datalogging memory is still available.

Baud Rate

The Model IAQ50 has a DEFAULT baud rate of 1200, which allows it to communicate with the optional portable Micro-Printer.

Setting the Real-Time Clock

The Model IAQ50 has an internal clock that keeps track of the time (the format is HH.MM where HH is the hour in 24-hour format and MM is minutes) and the date. It is very important to set the time and date correctly, otherwise date

and time stamping of recorded data will not be correct.

To set the time and date, press and hold either ▲ or ▼ key during the power-up sequence when the time is displayed. Release the keys when the Model IAQ50 beeps twice. You will have an opportunity to view and/or change the minutes (min), hours, year, month and date in sequence. Use the ▲ or ▼ key to change any settings. Use the ENTER key to store each setting and advance to the next one.

Barometric Pressure

The default barometric pressure is 29.92. To change this, press the ▲ or ▼ keys. Press ENTER to store the new value. Be sure to use "stations pressure" which may be available at the local airport. "Station pressure" is not corrected to sea level. The barometric pressure is used to correct the CO_2 readings and to calculate the wet bulb.

The instrument then displays current conditions. **To skip the start-up**

sequence, press and hold the ENTER key at any point of the start-up sequence, until the meter beeps.

Using the Sensing Probe

The sensing probe relies on the diffusion of air. For best results, try to keep the sensing probe surrounded by moving air.

Do not breathe on the probe, since humans exhale levels well exceeding 10,000 ppm CO_2 and it may take time for the probe to re-stabilize.

SECTION 4
Detailed Operation

Keypad Functions

When pressing the keys on the front panel, the Model IAQ50 will beep to confirm the function. If you press a key and it does not beep, the instrument does not allow that function during the selected mode.

ON/OFF Key

Press the ON/OFF key to turn the instrument on and off. When the instrument is first turned on, it goes through a preprogrammed power-up sequence that includes an internal self-check (when all displayable items are shown). The Model IAQ50 begins by displaying percentage of battery life remaining (accurate for alkaline batteries only), the percentage of memory available, baud rate, time (HH.MM) and entered barometric pressure. At this point, the Model IAQ50 will start measuring CO_2, temperature and % relative humidity.

If a problem is detected, the display will show "CAL" to indicate that it should be returned for service and/or calibration.

Note: To skip the start-up display, press and hold ENTER *at any time during the power-up sequence.*

CO_2 Key

The Model IAQ50 will automatically start in CO_2 mode. To return to this mode from another measurement pa-

rameter, press the CO_2 key. Then, place the probe in the location you want to measure gas concentration.

TEMP Key

The meter will always display temperature readings from the permanent sensor on the lower line of the display. When you wish to take an external temperature reading using an RTD probe, plug any three-pronged RTD probe into the right side. Then, press the TEMP key to view the temperature from the resistive temperature detector (RTD). The letters "Prb" will display on the top line of the display and the actual temperature from the RTD on the bottom line.

To return to reading temperatures from the permanent probe, press the TEMP key again.

Note: If the external RTD probe becomes unplugged while in "Prb" mode, the display will read "over." If the RTD probe is not plugged in and the TEMP key is pressed, nothing will happen.

HUMID Key

Press HUMID to toggle between %RH, dew point or wet bulb, (as displayed on the top line of the display). Dew point and wet bulb are displayed in the same units chosen for temperature measurement.

READ/ENTER Key

This is a dual function key. It reads measurement samples and it can be used to accept a value or condition or to return to regular measuring mode.

Press READ to take a sample reading; the instrument takes a measurement over five seconds. When the display is flashing SAMPLE, it counts down the five-second sample time: five, four, three, two. Then the display shows COUNT and a number. This is the number of individual readings in this test ID. All measurements are stored in memory.

Note: Be certain to press NEXT TEST *key to save readings into a different test ID.*

TIME LOG Key

To set up the instrument so it automatically takes measurements, use the TIME LOG key. This allows you to program a logging time and interval, and the meter will read and store measurements that can be viewed later.

Press the TIME LOG key. Use the ▲ or ▼ keys to select "On". Press the ENTER key.

"LOG" will light up on the display and the logging interval is shown. Use the ▲ or ▼ keys to scroll through the log interval choices. The choices are: 5, 6, 7, 8, 9, 10, 15, 20, 25, and 30 seconds (SEC), and 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, and 60 minutes (min). Press the ENTER key to accept your choice.

Next, you will choose the number of readings that you want the instrument to take. The choices are "COnt" or 1 to 9999. Use the ▲ or ▼ keys to scroll through the choices, and press ENTER to accept your choice. If "COnt" is cho-

sen, the instrument will sample continuously until it is either stopped manually, runs out of memory, or the batteries run out. If a number between 1 and 9999 is chosen, the instrument will take that number of samples and then stop storing readings.

The instrument will then return to a normal measuring mode.

Press ENTER to start the automatic time log. LOG will flash on the display while this function is running. You need to press ENTER to stop the logging function if it was set for "COnt". You may also press ENTER at any time during the logging function to cancel a preset number of samples.

The log mode remains programmed until you go into TIME LOG and turn this feature "OFF." Simply press ENTER to start another time log test.

NEXT TEST Key

Press NEXT TEST to advance to the next test ID. If the current test ID does not have anything stored, it will not advance to the next test ID.

The Model IAQ50 will automatically increment the test ID number under the following conditions:

- turning off the Model IAQ50 (if there is stored data)
- setting any data logging sample
- taking a %OA measurement after a normal sample
- taking a normal sample after a %OA measurement.

%OA (Percent Outside Air) Key

The percentage of outside air can be calculated using CO_2 or temperature measurements using the following equation:

Using CO_2:

$\%OA = (C_R - C_S) / (C_R - C_O) \times 100\%$

where %OA = Percentage of outside air

C_R = Concentration CO_2 of return air

C_S = Concentration CO_2 of supply air

C_O = Concentration CO_2 of outside air

Using Temperature:

$\%OA = (T_R - T_S) / (T_R - T_O) \times 100\%$

where %OA = Percentage of outside air

T_R = Temperature of return air

T_S = Temperature of supply air

T_O = Temperature of outside air

IMPORTANT:

Temperature readings should be taken at the Air Handling Unit only, since there may be components in the system that change the temperature that are not evident upon initial examination. Calculating Outside Air measurements by taking readings at the supply air to a room will not give the correct answer. Reheat coils and chiller coils will change the temperature of the readings and give incorrect answers.

The general procedure for either method is to take a reading in each of three modes: return air, outside air, and supply air. Pressing ENTER while in %OA mode will store all three samples and then give you the calculated value on the display. You may use the ▲ or ▼ keys to move from mode to mode. You may press the NEXT TEST key at any time to exit back to normal sampling.

Note: *You may press the %OA key at any time during the following procedure to exit without saving any data and to return to normal sampling*

Details on the procedure are as follows:

Press the %OA key once to begin. To choose a measurement mode (OA, SUPPLY, RETURN), use the ▲ or ▼ keys.

You may press TEMP or CO_2 at any time to move from calculating %OA from TEMP to CO_2 or from CO_2 to TEMP.

In return air mode, "RETURN" will appear on the display. The current value will show on the bottom line of the display. The top line of the display will show either dashes (if this is the first time using %OA function or if the memory has been cleared) or it will show the last value stored for return air. Press READ/ENTER once the reading has stabilized.

The stored measurement will display on the top line. This is the reading that will be used to calculate percentage of outside air.

If the measurement is not acceptable or the value is not yet stable, wait a minute and then take another reading to overwrite the value on the top line.

Once the top line value is acceptable, press the ▲ or ▼ keys to move the icon to either Supply or %OA, whichever reading you are prepared to make next.

Repeat the procedure with both a Supply measurement and an Outside Air measurement.

Remember, the top line measurement is what will be used in the calculation.

Once all three readings are stored, press the ▲ or ▼ keys to advance to %OA. "OA%" will appear on the display along with the % outside air value. To put this %OA value *and the values from the three other modes* into memory, press the READ/ENTER key.

Note: "Err" will display if not enough information is available or a negative % value is calculated

To make changes to one of the other three readings without putting these values to memory yet, press the ▲ or ▼ keys to review the values and press READ/ENTER to overwrite the value.

To exit this procedure completely without putting any values to memory, press NEXT TEST.

To take another % outside air measurement, make sure you pressed READ/ENTER to put the values to memory. Then use the ▲ or ▼ keys to review the measurements and take new samples for supply and return. The stored Outside Air reading can be used in all percentage calculations, unless you input a new value.

BP Key

To change the stored barometric pressure, press BP and use the ▲ or ▼ keys

to change the value. Press ENTER to return to normal measuring mode.

RECALL Key

The RECALL key lets you review data from a particular test ID.

Press the RECALL key. The most current test ID number will show on the display. Press ENTER to review measurements in this test ID, or use the ▲ or ▼ keys to choose another test ID to review. If dashes appear in the top line of the display, there is no stored data in that particular test ID.

Use up arrow to view average, total number of samples (count), minimum reading, maximum reading, and individual readings for the selected test ID. The samples will be displayed in the order that they were taken.

To view a different test ID, you need to press RECALL again.

The display will always show CO_2 measurements. To review other measure-

ments, press the desired measurement button. For example, if you wish to see humidity measurements, press HUMID. Press HUMID again to see dew point readings. For the external RTD, press the TEMP key. If there is no data for that measurement type "-----" will be displayed. Press another measurement key to view more data or press ENTER to return to measuring mode.

Note: To view return air, supply air or outside air data individually, you must download to computer or print out the values. %OA is reviewable on-screen

Arrow Keys (▲ ▼)

The two arrow keys are used to scroll through and select values as needed for Model IAQ50 functions. They are also used while in field calibration mode.

On the Model IAQ50, pressing either ▲ or ▼ key on the start-up sequence while baud rate, time or barometric pressure is displayed will allow you to change

them. Use the ▲ or ▼ key to adjust the value, and press ENTER to accept.

DEL Key

The Model IAQ50 lets you clear the last sample stored or the entire contents of memory.

To clear only the last sample, hold the DEL key and the display will begin a countdown from 3 to 0. Release the key *before* 0 is displayed. The display will beep twice and flash "CLEAR SAMPLE."

To clear all memory, press and hold the DEL key and the display will begin a countdown from 3 to 0. Release the key *while* 0 is displayed. The display will beep twice and flash "CLEAR LOG."

Note: If you release the key after *0 is displayed, it will not beep, and nothing will be deleted.*

Printing Data Using the Optional MicroPrinter

If the optional MicroPrinter is connected, what is viewed on-screen will be on the paper printout.

Note. In order to print, the baud rate on the Model IAQ50 must be set to the same as the printer. The default is 1200.

The data will print in a format such as 12,345.67. If you desire, the Model IAQ50 can print in a format such as 12.345,67 by switching DIP switch #8 ON. See "DIP Switch Settings" in Chapter 8.

Connecting the Optional MicroPrinter

To connect the MicroPrinter printer to the Model IAQ50, locate the Printer Interface Cable (supplied with the optional printer) and connect the 9-pin end labeled "PRINTER" to the printer and the other end to the data port of the Model IAQ50. The printer must be set to the same baud rate as the Model IAQ50. See *Baud Rate* section for details on how to change the baud rate. To change the baud rate of the

printer, please refer to the operation and service manual for the printer to properly set the printer's DIP switch settings. If the printer prints question marks (??????), asterisks (******), or random characters, reset it by turning it off and then on again. If necessary, refer to the Owner's Manual for the MicroPrinter.

SECTION 5
Maintenance

Probe Tip

Periodically inspect the probe tip to ensure that it is clean. Dust and oil deposits on the sensor may affect the response time of the Model IAQ50. To remove dust, blow it off with a gentle stream of air.

Caution:
To avoid possible irreparable damage, do ***not*** use liquid to clean the probe or probe tip.

Cases

If the instrument case or storage case needs cleaning, wipe it off with a soft cloth. Never submerge the Model IAQ50 in any liquid.

Storage

When storing the Model IAQ50 for more than a month, TSI recommends removing the batteries. This prevents possible damage due to battery leakage.

SECTION 6
Service and Calibration

Please return your Product Registration Card immediately. This allows us to send service reminders, special offers, and important information about your product.

Before sending your instrument for calibration or repair, you should call Customer Service. The service department will provide you with the cost of service or

calibration, Return Material Authorization (RMA) number, and shipping instructions.

Please have the following information available when you call:

- Owner's name, address, and phone number
- Billing address, if different and applicable
- Instrument name and model
- Serial number
- Date of purchase
- Where purchased

TSI recommends that you keep a "calibration log" and keep all records of service on your instrument.

Factory Calibration

To maintain a high degree of accuracy in your measurements, TSI recommends that you return your instrument to the factory for annual calibration. For a nominal fee, we will calibrate the unit and return it to you with a NIST (US National Institute of Standards and Technology) traceable certificate. This "annual checkup" assures you of consistently accurate readings; it is

especially important in applications where strict calibration records must be maintained.

Send the instrument to TSI Instruments Ltd. prepaid. Securely package your instrument in a strong container surrounded by at least 5 cm of suitable shock-absorbing material. Include a purchase order that clearly shows the instrument model number and serial number, a contact name, phone, fax number, and RMA number. Mark the outside of your shipping container with the RMA number. This will expedite processing of your instrument when we receive it.

Field Calibration

CO_2 Field Calibration Procedure

1. Turn the IAQ50 on and set the Barometric Pressure to the current Barometric Pressure. Be sure to use "station pressure" which may be available at the local airport. "Station pressure" is not corrected to sea level.
2. Turn the IAQ50 off and flip DIP switch #7 to ON.

3. Turn the IAQ50 on. It will flash "CAL" on the top row and beep intermittently.
4. Press and hold the CO_2 key to begin the calibration procedure. The display will begin a countdown from 5 to 0. Release the key when the display reads 0. If the key is released too soon or too late, the instrument will go back to beeping and flashing "CAL". If you've done this step correctly, "ZerO" will appear on the display and the beeping will have stopped.
5. Slide the calibration collar onto the probe until it stops. It should cover the set of holes closest to the handle.
6. Install the regulator on the zero calibration gas tank and connect tubing from the regulator to the inlet fitting on the CO_2 calibration collar.
7. Turn on gas flow.
8. Press and release the READ key to begin a zero reading. The IAQ50 begins a 60 second countdown during the zero reading. The actual zero reading is taken in the last 10 seconds. When the countdown is completed,

the display indicates "SPAN" and the span concentration.

9. Install the regulator on the span calibration cylinder and connect tubing from the regulator to the inlet fitting on the calibration collar.
10. Use ▲ and ▼ keys to adjust the concentration displayed on the IAQ50 to match the concentration on the span gas cylinder.
11. Press and release the READ key to take a span gas reading. The IAQ50 starts a 60 second countdown. When the countdown reaches zero, the instrument returns to the normal measurement mode.
12. With the gas still connected, observe the reading on the display. It should indicate the span gas concentration. If not, repeat the calibration.
13. If the displayed reading is accurate, remove the regulator and tubing.
14. Turn the IAQ50 off and flip DIP switch #7 to OFF (normal mode). The calibration is now complete.

Temperature and Humidity Calibrations Adjustment Procedure

The temperature adjustment can add or subtract a number of degrees. The range is ±9.99°F (±5.55°C). Calibration can be done in either °F or °C mode. Humidity adjustment adds or subtracts a constant percentage. The range is ±12.0% relative humidity. The procedure for field adjustment is as follows:

Turn off the instrument, flip DIP switch #7 to "ON." Turn the Model IAQ50 on again.

On the Model IAQ50, press and hold the parameter key you want to adjust to enter calibration mode. The display will begin a countdown from 5 to 0. Release the key when 0 is displayed. The top line of the display will show the adjustment number and the bottom line will show the actual reading value. Use the ▲ and ▼ keys to change the adjustment number and press READ key to accept. The meter returns to the measurement mode when the READ key is pressed. You must press and hold the parameter you want to adjust to access

it. When finished, turn the instrument off and flip DIP switch #7 to "off."

On the Model IAQ50, press and hold the TEMP or HUMIDITY key to enter the calibration mode for that parameter. To enter the calibration mode for the RTD, make sure the RTD is plugged in. Press the TEMP key until "Prb" shows on the display, then press and hold the TEMP key.

The display will begin a countdown from 5 to 0. Release the key when 0 is displayed. The top line of the display will show the adjustment number (factory setting is 0.0) and the bottom line will show the actual reading value. Use ▲ or ▼ keys to change the adjustment number and press ENTER to accept. If necessary, repeat the above sequence for the other parameters. When finished, turn the instrument off and flip DIP switch #7 to "off."

SECTION 7
Troubleshooting

Table 7-1 lists the symptoms, possible causes, and recommended solutions for common problems encountered with the Model IAQ50. If your symptom is not listed, or if none of the corrective actions solve your problem, please contact TSI Instruments Ltd.

Table 7-1: Troubleshooting the Model IAQ50

Symptom	Possible Causes	Corrective Action
No display	Unit not switched on	Switch on the unit.
	Low or dead batteries	Replace the batteries or plug in the AC adapter.
	Dirty battery contacts	Clean the battery contacts.
Battery symbol is blinking	Batteries are low, 15% or less life remaining	Replace batteries.

Symptom	Possible Causes	Corrective Action
Display reads "LO"	Wrong AC adapter	Replace with the correct AC adapter.
	Low AC line voltage	Correct the AC line voltage or use batteries.
	Dirty battery contacts	Clean the battery contacts.
Display reads "CAL"	The Model IAQ50 has detected an internal fault	Return to factory for service.
Display reads "OVER"	A parameter value is too high.	Use an alternate method to make measurement.
	RTD became unplugged while reading RTD temperature.	Plug in the RTD
Temp. initially reads high or low	Temperature sensor is still adjusting to temperature	Allow sufficient time for the temperature to stabilize.

Symptom	Possible Causes	Corrective Action
Display reads "LOG FULL"	You are trying to enter more readings than memory can handle	Read or record the average; clear the sample register and proceed.
Display flashes "Lbatt"	Low lithium battery power	Return to factory for replacement.

SECTION 8
DIP Switch Settings

To access the DIP switches, remove the batteries from the battery compartment. On the inside of the battery compartment, there is a window with eight DIP switches. The table below shows the functions for each switch.

Caution:
Make certain that power is turned off before changing DIP switch settings.

Table 8-1: DIP Switch Settings

Switch	OFF	ON
1-3	Must be OFF	-------
4	Not assigned	-------
5	°F	°C
6	Buzzer OFF	Buzzer ON
7	Normal Mode	Calibrate Mode
8	American Date Format and 12,345.67	European Date Format and 12.345,67

The ON position is away from the batteries and OFF is towards the batteries. Always leave DIP switch #1–4 in the OFF position.

Specifications

Specifications are subject to change without notice.

CO_2	
Range:	0 to 5000 ppm
Accuracy:[1]	±3% of reading at 25°C or ± 50 ppm, whichever is greater
Resolution:	1 ppm
Sensor Type	Dual wavelength NDIR (Non-dispersive Infrared)
Temperature:	
Range:	0 to 60°C
Accuracy:	± 0.6°C
Resolution:	0.1°C
Secondary Temperature Probe (optional):	
Range:	-40 to 120°C
Accuracy:	±0.6°C
Resolution:	0.1°C
Sensor Type:	RTD -100 ohms, 3 terminal
Relative Humidity:	
Range:	5% to 95% RH
Accuracy[2]	±3.0% RH
Resolution:	0.1% RH
Sensor Type:	Thin-film capacitive
Dew Point:	
Range:	-15 to 49°C
Resolution :	0.1°C

Wet Bulb:	
Range:	5 to 60°C
Resolution:	0.1°C
% Outside Air:	
Range:	0 to 100%
Resolution:	0.1%
Logging Capability:	Up to 14,000 measurements in 1000 test ID's
Intervals:	5,6,7,8,9,10,15,20,25, 30 sec. 1,2,3,4,5,6,7,8,9,10,15, 20,25,30,60 min.
Meter Dimensions:	89 mm × 168 mm × 41 mm
Weight (with batteries):	0.53 kg
Probe length:	175 mm
Probe tip diameter:	19 mm
Display:	2 line, 4-digit LCD
Operating Range:	5 to 70°C
Storage Range:	-20 to 70°C
Power Requirements:	Four AA-size batteries (included) or AC adapter (optional)
Printer Interface Type:	Serial, 1200 baud

1 Add ±0.36% / deg C away from calibration temperature
2 At 25°C. Add uncertainty of ±0.05% /°C away from calibrated temperature

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October 2005
Printed in USA
Part No. 1980533, Rev. A

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